TMM003 – TRIGONOMETRY
3-4 Semester Hours/4-5 Quarter Hours

Recommendation: This course should significantly reflect the Mathematical Association of America's Committee on the Undergraduate Program in Mathematics (CUPM) Curriculum Guide.

Related TAGs: Civil/Construction Engineering Technology, Mechanical Engineering Technology, Electrical Engineering Technology

A Trigonometry course may be taken by students preparing to take algebra-based Physics or, together with a suitable College Algebra course, may be taken by students preparing for a traditional calculus sequence. A Trigonometry course is generally not as accelerated as a traditional Pre-Calculus course. Since a Trigonometry course covers many of the same learning outcomes as Pre-Calculus, statements regarding TMM002 Pre-Calculus in the MAA/CUPM 2004 Curriculum Guide also apply to Trigonometry.

Students who are preparing to study calculus need to develop conceptual understanding as well as computational skills. Appropriately designed Trigonometry courses can enable students to be successful in calculus. Often, creation of an effective Trigonometry course requires learning about different curricular and pedagogical approaches and experimenting with how the most promising ones might be adapted for local implementation. No course should have value *only* as a preparation for a subsequent course; it should have intrinsic value on its own as well as offering preparation for further study.

A Trigonometry course should develop mathematical thinking and communications skills by incorporating activities that will help all students progress in developing analytical, critical reasoning, problem-solving, and communication skills and acquiring mathematical habits of mind. More specifically, these activities should be designed to advance and measure students' progress in learning to:

- State problems carefully, modify problems when necessary to make them tractable, articulate assumptions, appreciate the value of precise definition, reason logically to conclusions, and interpret results intelligently;
- Approach problem solving with a willingness to try multiple approaches, persist in the face of difficulties, assess the correctness of solutions, explore examples, pose questions, and devise and test conjectures;
- Read mathematics with understanding and communicate mathematical ideas with clarity and coherence through writing and speaking.

A Trigonometry course should communicate the breadth and interconnections of the mathematical sciences by:

- Presenting key ideas and concepts from a variety of perspectives;
- Employing a broad range of examples and applications to illustrate and motivate the material;
- Promoting awareness of connections to other subjects (both in and out of the mathematical sciences), and strengthen each student's ability to apply the course material to these subjects;
- Introduce contemporary topics from the mathematical sciences and their applications, and enhance student perceptions of the vitality and importance of mathematics in the modern world.

– Adapted from the MAA/CUPM 2004 Curriculum Guide

The prerequisite for Trigonometry is generally by placement or by TMM 001 College Algebra.

To qualify for TMM003 (Trigonometry), a course must cover as a minimum the essential learning outcomes, noted by an asterisk *, which include all the topics under Functions, Equations, Angles/Triangles, Identities, and Vectors. A course in Trigonometry may also commonly include some of the listed nonessential learning outcomes. These optional topics should be included only if there is adequate course time to do so beyond giving primary course attention to the essential learning outcomes. At least 70% of the classroom instructional

time has to be spent on the essential learning outcomes. The optional learning outcomes are learning experiences that enhance, reinforce, enrich or are further applications of the essential learning outcomes. If review of prerequisite course content is necessary, only a minimal amount of time should be devoted to such review.

The successful Trigonometry student should be able to:

1. **Functions ***

   1.1 Represent trigonometric and inverse trigonometric functions verbally, numerically, graphically and algebraically; define the six trigonometric functions in terms of right triangles and the unit circle.

   1.2 Perform transformations of trigonometric and inverse trigonometric functions – translations, reflections and stretching and shrinking (amplitude, period and phase shift).

   1.3 Analyze the algebraic structure and graph of trigonometric and inverse trigonometric functions to determine intercepts, domain, range, intervals on which the function is increasing, decreasing or constant, asymptotes, whether the function is one-to-one, whether the graph has symmetry (even/odd), etc., and given the graph of a function to determine possible algebraic definitions.

   1.4 Use trigonometric and inverse trigonometric functions to model a variety of real-world problem-solving applications.

2. **Equations ***

   2.1 Solve a variety of trigonometric and inverse trigonometric equations, including those requiring the use of the fundamental trigonometric identities listed in (4.4), in degrees and radians for both special and non-special angles. Solve application problems that involve such equations.

3. **Angles/Triangles ***

   3.1 Express angles in both degree and radian measure.

   3.2 Solve right and oblique triangles in degrees and radians for both special and non-special angles, and solve application problems that involve right and oblique triangles.

4. **Identities ***

   4.1 Verify trigonometric identities by algebraically manipulating trigonometric expressions using fundamental trigonometric identities, including the Pythagorean, sum and difference of angles, double-angle and half-angle identities.

5. **Vectors ***

   5.1 Represent vectors graphically in both rectangular and polar coordinates and understand the conceptual and notational difference between a vector and a point in the plane.

   5.2 Perform basic vector operations both graphically and algebraically – addition, subtraction and scalar multiplication.

5.3 Solve application problems using vectors.

6. Graph complex numbers in the complex plane in both rectangular and polar form, perform operations on such numbers – addition, subtraction, multiplication and division, and use DeMoivre's Theorem to find the n^{th} roots of a complex number.

7. Convert points and equations between rectangular and polar form, graph polar functions, solve polar equations, identify and express the conics in standard polar form for graphing, and solve applied problems involving conics in polar form.

8. Identify and graph a curve defined by parametric equations by making a table of values and, when possible, eliminating the parameter.